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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems	PR Docket No. 93-61 RM-8013

COMMENTS OF NORAND CORPORATION

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SUMMARY

Norand opposes adoption of the proposed rules creating a new Location and Monitoring Service ("LMS") in the 902-928 MHz bands. Norand urges the Commission to undertake further proceedings to assess the impact of this proposal on other users in these bands, particularly users of unlicensed Part 15 devices, and on the public interest in general.

Part 15 spread spectrum products have become a significant component of the data processing and data communications operations of many U.S. companies. The Commission's Part 15 initiatives have created a regulatory environment which has fostered substantial innovation and a wide variety of products. Norand and other manufacturers have invested millions of dollars in research and development with an expectation that this regulatory environment would remain stable and conducive to such innovation. The Commission should not overlook the many business and industrial applications for Part 15 products.

The technical characteristics of LMS could drastically curtail the operation of Part 15 devices in the 902-928 MHZ band, particularly those devices employing spread spectrum technology. Moreover, LMS use of the 902-928 MHz bands would be secondary to the use of these bands by the Federal Government and ISM devices. If narrowband LMS can disrupt wideband LMS, as the Commission has concluded, it is probable that the primary uses of the 902-928 MHz bands will as well.

LMS also raises questions about continuous human exposure to LMS radio frequency emissions. The power level of five watts for LMS power units appears to be at variance with personal RF exposure standards recently adopted by the American National Standards Institute. The Commission should weigh the risks of increased RF personal exposure levels

and the costs of reducing these levels in any decision to adopt the LMS rule changes.

Norand has serious concerns about proposals to migrate narrowband LMS to bands outside those reserved for wideband LMS. The migration and concentration of narrowband LMS would compound the problem created by the large allocation of spectrum to wideband LMS, and would have a severe impact on the operations of Part 15 devices authorized to operate in those bands. A limited migration approach will serve to reduce somewhat the disruption of Part 15 operations because of harmful interference from narrowband LMS.

Another issue before the Commission is how the public interest is served by dedicating spectrum to a technology with admitted bandwidth inefficiencies, when other technologies may achieve results on a more efficient basis which would be comparable to LMS as proposed. Systems incorporating rapidly evolving bandwidth efficient modulation technologies could conceivably offer spectrum efficiencies several orders of magnitude greater than LMS. There are also indications that the full amount of bandwidth which the Notice proposes to allocate is not really necessary for implementation of LMS, even without these improvements. Moreover, there is no technical requirement that such implementation must be conducted in the 902-928 MHz bands. Other spectrum, including frequencies which may soon be reallocated from government use, could be utilized.

Because the record in this proceeding does not adequately address many crucial issues, the Commission cannot adopt now the proposal to establish LMS. The Commission must seek relevant data on the issues discussed here, and fully assess these issues, in making its public interest determination in this proceeding.

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Norand Corporation ("Norand"), by its attorneys, hereby comments on the Commission's Notice of Proposed Rulemaking in the above-referenced docket, released April 9, 1993 ("Notice").[1]

For the reasons discussed below, Norand opposes adoption of the proposed rules creating a new Location and Monitoring Service ("LMS") in the 902-928 MHz bands. The concerns raised by this proposal are so serious that, in any event, the Commission could not lawfully authorize these amendments without seeking further information to resolve the issues discussed in these comments.[2] Norand therefore urges the Commission to

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1/ Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems, 8 FCC Rcd 2503 (1993) ("Notice").

2/ See Motor Vehicle Manufacturers Ass'n v. State Farm, 463 U.S. 29, 42-43 (1983) (an agency's "change in course" by way of a rule change must be supported by a reasoned analysis; the agency may not fail "to consider an important aspect of the problem"); see also Eagle-Picher Industries v. EPA, 759 F.2d 905, 921 (D.C. Cir. 1985) (agency action based on a "predictive analysis" requires that "the agency has examined the relevant data and articulated a rational explanation for its action").

undertake further proceedings to assess the impact of this proposal on other users in these bands and the public interest in general. In particular, Norand requests that the Commission give serious consideration to the negative effects of these proposed rule changes on the development and use of innovative data communications products currently authorized to operate in the 902-928 MHz bands under Section 15.247 of the Commission's rules.

I. INTRODUCTION AND STATEMENT OF INTEREST

Norand is a publicly traded corporation which manufactures and distributes state-of-the-art portable computer products and associated systems for use in the warehousing, shipping, manufacturing, and retail business sectors. Since the early 1980s, Norand has been a leader in developing and manufacturing radio frequency data collection systems, and such systems now comprise a substantial portion of Norand's product line. Norand has installed its systems in over 2,000 locations worldwide. Norand has received over a dozen equipment authorizations from the Commission under Part 90 of the Commission's rules, as well as several equipment certifications under Part 15. Norand has additional Part 15 applications pending.

These systems deploy narrowband transceivers, including low-power devices which are certified under Section 2.907 to operate under Part 15 of the Commission's rules. These devices utilize spread spectrum radio communications for real-time access to customers' computer facilities. Norand's products thus enable on-line control of inventory movement, work-in-process, order processing, and shipping and receiving. On-line access and control eliminates paperwork and processing errors, speeds customer operations, and allows customers to improve productivity and quality levels.

Use of on-line systems provides customers with significant economic returns. Productivity improvements and savings amounting to five to ten times the purchase price of the equipment are commonly achieved results in many locations. United States companies are not only the leaders in developing this technology, but U.S.-based customers and the nation's economy are also the beneficiaries of the increased efficiency resulting from the use of these devices.

Part 15 spread spectrum products have become a significant component of the data processing and data communications operations of many Fortune 500 companies and smaller firms. The Commission's initiatives over the last eight years have created a regulatory environment which has fostered substantial innovation beyond what is possible with more traditional narrowband products and systems. Norand and other manufacturers have invested millions of dollars in research and development with an expectation that this regulatory environment would remain stable and conducive to such innovation. It is with this background that Norand offers its comments on the Commission's Notice in this proceeding.

II. THE COMMISSION MUST ASSESS SEVERAL PUBLIC INTEREST FACTORS NOT ADDRESSED IN THE NOTICE, INCLUDING THE IMPACT ON THE USE AND DEVELOPMENT OF PART 15 DEVICES, BEFORE ADOPTING THE SUBSTANTIAL CHANGES ENTAILED BY LMS.

A. The Commission's Recent Part 15 Amendments Are A Significant Success.

In 1985, the Commission first amended Part 15 to allow the use of spread spectrum technology in the 902-928 MHz, 2.4 GHz, and 5.8 GHz bands.[3] Subsequent amendments in 1989 and 1990 further developed

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3/ Authorization of Spread Spectrum Systems Under Parts 15 and 90 of the Commission's Rules and Regulations, 117 Fed. Reg. 25234 (1985).

rules for the use of spread spectrum direct sequence and frequency [illegible]

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wireless private branch exchange ("PBX") systems, wireless local area network ("LAN") devices, wireless retail point-of-sale systems, wireless portable data transmission systems, wireless microphones and musical instrument device interfaces ("MIDI"), wireless heating and cooling monitoring and control systems, wireless audio and video distribution systems, automated meter readers, hospital automation systems, remote systems for traffic light control and utility substation monitoring, wireless home and business security systems, cordless telephones, and remote control toys. While many of these products are "consumer-oriented Part 15 devices," as the Commission has noted,[8] the Commission should not overlook the many business and industrial applications for Part 15 products.

Numerous spread spectrum Part 15 devices have been developed and literally millions have been deployed. In the 902-928 MHz bands, this has been accomplished with a regulatory framework that that allows co-existence of federal government users and industrial, scientific, and medical ("ISM") devices as the primary allocation, with secondary use granted to automatic vehicle monitoring ("AVM") and amateur radio. In light of these advances, the Commission must consider whether the public interest will be served if AVM, an established service, is transmuted into what is proposed as LMS.

B. The Creation Of A New Location And Monitoring Service As Proposed In The Notice Raises Serious Public Interest Issues, Including The Effects On Continued Operation Of Part 15 Devices In The 902-928 MHz Bands.

As an experienced manufacturer of devices that operate pursuant to the Commission's Part 15 rules, Norand is fully cognizant of the

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8/ Notice, 8 FCC Rcd at 2506 (¶ 24).

requirements that such devices must accept interference from licensed users of shared frequency bands and that these devices must not cause interference which is harmful to licensed users. Nevertheless, as explained above, Norand and others have made considerable investment and produced significant public benefits through the development and distribution of Part 15 devices operating in the bands where the Commission now proposes to establish the new LMS service.

The technical characteristics of LMS, as proposed, could drastically curtail the operation of Part 15 devices in the 902-928 MHZ band, particularly those devices employing spread spectrum technology. Moreover, the technical description of LMS raises questions about the viability and spectrum efficiency of this proposed service in its own right, independent of any Part 15 concerns. Norand offers a discussion of some of these issues in the following paragraphs.

1. LMS interference susceptibility

Paragraphs 12-14 of the Notice provide a discussion of the co-channel interference characteristics of the proposed LMS system, based on the interference study provided by North American Teletrac ("Teletrac"), the party whose petition for rulemaking initiated this proceeding.[9] The Notice concludes that "co-channel noise in the vicinity of a wideband pulse ranging system [as proposed for LMS] does make it difficult, if not impossible, for the system to operate effectively" and proposes that narrowband LMS not be licensed on the same bands as wideband pulse-ranging LMS.[10]

9/ Id. at 2504 & n.29.

10/ Id. at 2504 (¶ 14).

AVM (and proposed LMS) use of the 902-928 MHz bands is secondary to the use of these bands by the Federal Government and ISM devices. If narrowband LMS can disrupt wideband LMS, it is probable that these other uses will as well. The Notice simply allows that "thus far, interference received from government radar systems or ISM equipment has not been a problem."[11] This experience is very limited, however: only five wideband LMS systems have been deployed, although hundreds are anticipated if the Notice's proposals are adopted. There are thousands of ISM devices deployed, which are unlicensed and allowed to operate with unlimited radiated energy at their specified frequencies, including the 902-928 MHz bands. Some of these devices operate on a "frequency sweeping" basis, covering the entire authorized band in the course of their operations.

The susceptibility of wideband LMS to interference from ISM devices and government use, not to mention from secondary users of the 902-928 MHz band such as Part 15 devices and amateur radio, raises serious questions about the accuracy and coverage of LMS as proposed. Even further "corrective surgery" will likely be necessary if the Commission acts on LMS as proposed, or else the commercial viability of LMS will be at risk because of the expense of installing significantly more base stations in order to minimize co-channel interference from primary and secondary sources.[12]

11/ Notice, 8 FCC Rcd at 2506 (¶ 23).

12/ One current use of AVM systems, which would be greatly expanded with the adoption of the proposed LMS rules, is stolen vehicle location and identification. LMS technical characteristics, notably its susceptibility to interference, would make it a target for illegal jamming. Jamming devices can be constructed based upon knowledge of the LMS frequencies, transmitted power levels, and antenna gains. Use of such a jammer would also disrupt operation of other devices in the LMS bands over a relatively wide area.

2. LMS radio frequency exposure levels

A proposed use of LMS is continual location monitoring of vehicles and individuals, targeted for law enforcement, corporate fleet tracking, and personal locator services.[13] These proposed uses raise questions about continuous human exposure to LMS radio frequency emissions. The Teletrac interference study assumes a power level of five watts for LMS power units,[14] which is significantly higher than the .6 to 3 watt power range of portable cellular telephones, for example. This power level would also seem to be at variance with standards for personal RF exposure levels recently adopted by the American National Standards Institute ("ANSI") in association with the Institute of Electrical and Electronic Engineers.[15] Adjustment of the Commission's rules regarding personal RF exposure levels is the subject of a recently released notice of inquiry which was prompted by the new ANSI standards.[16]

For vehicular applications, these concerns could be alleviated with proper installation providing passengers with distance and/or shielding

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13/ Petition for Rulemaking, North American Teletrac and Location Technologies, Inc., RM-8013, at 8-14 (filed May 28, 1992) ("Teletrac Petition").

14/ Teletrac Petition, Appendix 2, at 14.

15/ See ANSI/IEEE C95.1-1992 (adopted Nov. 18, 1992). For Norand's hand-held equipment operating in the 901-928 MHz bands, the appropriate power level under the new ANSI standard is approximately one half watt.

16/ Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, 8 FCC Rcd 2849 (1993). The Commission proposed to adopt exclusions for low-power devices as provided in the 1992 ANSI/IEEE guidelines. As an illustration, the Commission noted that to qualify for an exclusion in an "uncontrolled environment" (i.e., where persons are not aware of exposure), a low-power device operating in the 800 MHz band could not exceed 0.79 watts radiated power. At 1500 MHz, the exclusion level would be 0.42 watts. Id. at 2851 & n.20.

from the LMS transmitter. The question remains as to how such installation procedures could be readily enforced. Personal location applications would appear to be more problematic, and could only readily be resolved through reduction of transmission power levels. Such a change would require a significantly greater number of LMS base stations to maintain accuracy and would substantially increase the cost of the service. The Commission should weigh the risks of increased RF personal exposure levels and the costs of reducing these levels in any decision to adopt the LMS rule changes.

3. LMS narrowband migration and consequences for Part 15 devices

Norand has serious concerns about the proposals in paragraphs 16 and 18 of the Notice to migrate narrowband LMS to bands outside those reserved for wideband LMS, and to license new narrowband LMS systems only in those bands. Given the susceptibility of wideband LMS to interference and the likely detrimental effect of wideband LMS on Part 15 devices, some Part 15 manufacturers could, at additional expense, re-engineer their future products to operate in the 902-928 MHz bands outside of the bands occupied by wideband LMS.[17] If there is a significant degree of narrowband LMS migration as well, however, these protective measures by Part 15 manufacturers would be to little avail.

In particular, Norand urges the Commission to avoid narrowband LMS migration to the center band at 912-918 MHz and, if some migration is deemed to be necessary, to require it at the peripheral bands at 902-904 and 926-928 MHz.[18] Norand also urges the Commission not to promote

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17/ For many users, the more "economic" approach would be simply to discard their current devices and find some form of replacement.

18/ This approach would correspond with the channelization scheme proposed by Teletrac. See Teletrac Petition, Appendix 1, at 6.

the migration of narrowband LMS to the 2.4 GHz band, as proposed in the Notice.[19] Norand and others are engaged in spread spectrum Part 15 product development in this band as well, as provided under Section 15.247 of the Commission's rules. A limited migration approach will serve to reduce somewhat the disruption of Part 15 operations because of harmful interference from narrowband LMS.

The "tagging" technologies used in many narrowband LMS systems usually involve transmission over a few meters at most, but can create interference over a radius of several miles in the same narrow bands where Part 15 devices would be required to operate.[20] The migration and concentration of narrowband LMS would thus compound the problem created by the allocation of 16 MHz of spectrum to wideband LMS, and would have a severe impact on the operations of Part 15 devices authorized to operate in those bands. The Commission must assess this impact before moving ahead with its allocation and migration proposals.

4. LMS spectrum efficiency and alternative technologies

The Notice proposes to devote 16 MHz of spectrum for non-exclusive wideband LMS licensing in the 904-912 and 918-926 MHz bands. While such a large allocation of bandwidth may be necessary for LMS to operate at desirable accuracy levels,[21] the question remains whether this is

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19/ Notice at 2505 (¶ 18).

20/ This is because of the power levels at which narrowband LMS operates, levels that are usually much higher than necessary for the task at hand. Many of the applications of narrowband LMS (e.g., "coinless tollgates," etc.) raise issues of personal RF exposure similar to those discussed above for wideband LMS. The Commission should consider reductions in the permitted power levels (proposed at 300 watts ERP) for narrowband LMS in order to mitigate these interference and biological consequences.

21/ This allocation may be necessary, but is probably not sufficient. See the discussion of co-channel interference offered above with respect to the primary uses for these bands.

the most efficient use of spectrum in these bands. The question before the Commission is how the public interest is served by dedicating spectrum to a technology which is admittedly inefficient as a communications system in order to obtain accuracy as a location system.[22]

Other technologies may achieve results on a more efficient basis which would be comparable to LMS as proposed. Bandwidth efficient modulation technologies are rapidly evolving, spurred by the Commission's initiatives in promoting emerging technologies and, in particular, personal communications services. Current-day, low cost transceivers are now capable of communicating 0.5 to 1 bit per second of information for each one Hz of bandwidth.[23] Improvements expected in the near future may multiply these efficiencies by as much as a factor of four. Digital wireless data communications technology will be capable of providing an enormous amount of information when compared to the analog capabilities of only a few years ago.

Except for "forward signalling" techniques, these improvements play no significant role in the technology proposed to be implemented for LMS. No consideration has yet been given to combinations of radiolocation technology (such as that utilized in the satellite-based Global Positioning Service) and digital radio communications technologies that could enhance

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22/ See, e.g., Response of North American Teletrac and Location Technologies dba PacTel Teletrac to the Comments of the Missile Group Old Crows, RM-8013, at 5-8 (filed Jan. 14, 1993) ("Teletrac Response to Missile Group").

23/ See, e.g., FCC Amends Rules to Establish New Narrowband Personal Communications Services (Gen. Docket No. 90-314, ET Docket No. 92-100), Report No. DC-2447 at 2 (released June 24, 1993) (reporting award of pioneer's preference for Mtel's "multicarrier modulation" technology capable of transmitting a 24 kilobits-per-second simulcast signal in a 50kHz channel).

both location accuracy and communications of position information. Integrating such complementary systems may require substantial hardware and software innovations, but would utilize much less bandwidth. Integrated systems of this nature would likely be able to utilize capacity in the emerging digital cellular and special mobile radio services. Such approaches could conceivably offer spectrum efficiencies several orders of magnitude greater than LMS, when analyzed in terms of bits communicated over available bandwidth.

Finally, there is the issue of competing LMS technologies. Southwestern Bell has suggested that 4 Mhz or less, rather than 8 MHz, is sufficient for an operating LMS system.[24] A comparison of these differing approaches has not yet been fully realized. Indeed, there is some indication that the full 8 MHz is not really necessary for implementation of the Teletrac approach, but would include a substantial amount of bandwidth reserved for additional subscribers and "new services."[25]

Moreover, there is no technical requirement that any expansion of AVM technology must be conducted in the 902-928 MHz bands. Virtually any spectrum between 500 MHz and 2 GHz would appear to be appropriate for implementation of the system proposed in Teletrac's petition for rulemaking. Rather than disrupt Part 15 and other users in the shared 900 MHz band, the Commission may wish to postpone consideration of the LMS proposal until it acquires authority by Congressional action to license services on bands previously dedicated to government use, action which is

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24/ E.g., Reply Comments of Southwestern Bell Corp., RM-8013, at 3 (filed Aug. 7, 1992).

25/ See Teletrac Response to Missile Group at 12.

expected in the relatively near future.[26] In short, the Commission has several alternatives to adoption of LMS as proposed, alternatives which should be given serious consideration on a forward-looking basis.

* * *

Norand strongly believes that it is incumbent upon the Commission to fully assess the susceptibility of LMS to ISM interference, the impact of the proposed power levels of LMS, the spectrum efficiency of LMS, and the consequences for current and future Part 15 operations in the 902-928 MHz bands before adoption of any of the proposals in the Notice. These issues have not been addressed by the proponents of this service. It is likely that other parties with interests in the use of the 902-928 MHz bands will have similar or additional concerns. LMS proponents undoubtedly can provide information responsive to these concerns. The Commission must seek supplemental comments from LMS proponents based on appropriate test and technical analyses.

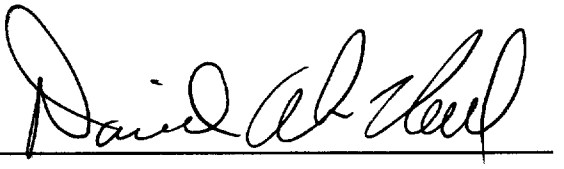
III. CONCLUSION

Because the record in this proceeding does not adequately address many crucial issues, some of which are discussed above, the

the impact of these changes on the users of these bands, particularly users employing Part 15 devices, the susceptibility of LMS to interference, the radio frequency exposure to humans from LMS, and efficient use of spectrum for LMS when compared to alternative technologies, in making its public interest determination in this proceeding.

Respectfully submitted,

NORAND CORPORATION

By: 

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